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# United States Patent [19]

Carman, II

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[54] **UNIVERSAL SYMBOLIC HANDWRITING RECOGNITION SYSTEM**

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[52] **U.S. Cl.** ..... **382/186**; 382/187

[58] **Field of Search** ..... 382/13, 24, 30, 382/34; 178/18

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[57] **ABSTRACT**

A universal symbolic handwriting recognition system for converting user entered time ordered stroke sequences into computer readable text is described. The system operates on two levels: (1) a word-level recognizer, which recognizes the entire group of strokes as a unit, and (2) a parser-level recognizer, which breaks the strokes into segments and recognizes groups of stroke segments within a word, thus recognizing separate characters or character sequences within a word to build a complete recognition string. In both recognition levels, the system trains on actual user samples, either on an entire word, or on a character or character sequence within a word. It does so by building a user specific sample recognition data-base file of text/pattern pairs, where the text is specified by the user in a word confirmation process and the pattern, composed of an index and a feature vector, is created from the actual user input strokes. Thus, as the user continues to use the recognition system and augments his/her user specific sample recognition data-base file, the correct recognition rate climbs approaching 100 percent in normal usage. The word-level recognizer can also be used to train on abbreviations, custom shorthands, and pictographic characters, such as the Japanese Kanji, or Chinese. An abbreviated Japanese Kanji or Chinese handwritten entry can even be trained for recognition. The text in the user specific sample data-base file is maintained in the Unicode format, and the user can specify the recognized return string format as either Unicode, ANSI, or JIS.

**41 Claims, 13 Drawing Sheets**